GSOE9210 Engineering Decisions

Problem Set 03

1. For the 'bus or train' example from lectures, suppose that normal walking speed is 3km/hr. There's a 15-minute wait for the bus down Liverpool Road and 10 minutes for the bus up Parramatta Road. The wait for the train is 20 minutes. The train takes 10 minutes to get to Ashfield station and the bus trip down Liverpool St is 15 minutes, while the bus up Parramatta Rd takes 10 minutes.

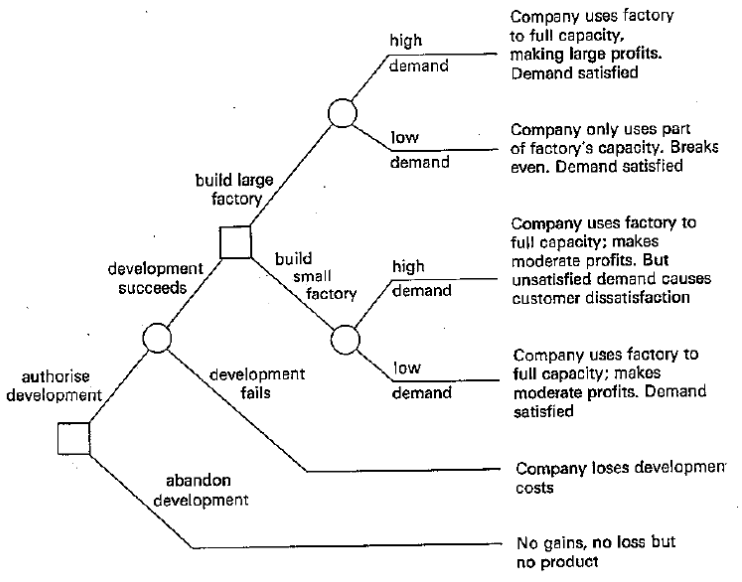
   Let the value function v be the total travel time from A to B in minutes.

   Assume the walking distances are as in the lecture notes (below in kms):

ω	$d(\omega, \mathrm{B})$
C	4
D	1
E	2

   (a) Represent this problem in extensive form, showing travel times.
   (b) Draw the normal form (table) representation of this problem.
   (c) Using the two methods above, calculate the value of the problem under *Maximin* (*i.e.*, the value of the action chosen under *Maximin*)

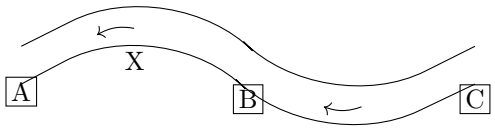
2. The manufacturing problem discussed in lectures is reproduced below.



Using the value function given in lectures:

(a) Find the *Maximin* and *miniMax Regret* strategies for this problem.
(b) Evaluate this problem under *MaxiMax*, *Maximin*, *miniMax Regret* using both normal and extensive forms.

3. In lectures we looked at Alice's river trading problem:



The fuel (in litres) required to travel to C from each starting point is:

	A	X	B	C
To C from:	4	3	2	0

(a) Without the aid of a ferry, what is the fuel usage to get from X to each of A, B, and C?
(b) If Alice starts at X, consider the ways in which Alice might get to C:
   A float down to A, then get to C from A
   B travel to B, then get to C from B
   C travel to C

   Calculate the fuel required to get to C via the strategies above on a day in which: i. the ferry is operating; ii. the ferry isn't operating. Produce a 'loss table' with these values as 'losses'.
(c) Transform these values to produce a decision table for this problem in which more preferred outcomes receive higher values. Which transformation did you use?
   [Hint: use a transformation that produces the 'fuel saved/remaining fuel in the tank' values from lectures.]
(d) Calculate the regret table for this problem.
(e) Determine *Maximin*, *miniMax Regret* strategies and values for this problem.
(f) Which strategies, if any, are dominated?

4. Consider the decision table below:

	s_1	s_2	s_3
A	3	4	2
B	4	4	3
C	5	6	3

(a) Which strategies in the decision table shown are dominated?
(b) If regret is measured, which strategies are dominated?

5. Consider the decision table shown below:

	s_1	s_2
A	0	4
B	3	1
C	2	3
D	1	2

A strategy is termed *admissible* if it is not strictly dominated by any other strategy. A strategy which is not admissible is called *inadmissible*.

(a) Which strategies are admissible?
(b) Under what circumstances should a decision-maker choose an inadmissible action/strategy?

6. We saw in lectures the following table listing the rules which always eliminate dominated strategies (for strict and weak dominance respectively).

Rule	Strict	Weak
MaxiMax	$\surd$	$\times$
Maximin	$\surd$	$\times$
Hurwicz's	$\surd$	$\times$
miniMax Regret	$\surd$	$\times$
Laplace's	$\surd$	$\surd$

Verify the properties above, giving counterexamples where relevant.

7. For this problem you'll be using the decision table below:

	s_1	s_2
A	2	3
B	4	0
C	3	3
D	5	2
E	3	5

(a) Graph the strategies.
(b) Which strategies are dominated: i. weakly; ii. strictly.
(c) Draw the dominance region for C (*i.e.*, the region of all strategies which dominate C).
(d) List the indifference classes for this problem.

8. Alice is considering whether to invest \$1000 over an investment period, and if so on which option to invest. She is looking at an investment market which will either rise (r) by 9% or fall (f) by 4% over the investment period. She must submit her instruction to invest (I) or not to her stock broker before the market movement is known. After learning of the market position, she can choose to invest in option F, which gives a fixed return of 5%, or risky option R which follows the market's movement.

(a) Represent this situation as a decision tree (*i.e.*, in extensive form) and convert this to a decision table (normal form).
(b) Graph the strategies showing the *Maximin* indifference curves.
(c) Which policy should Alice choose under *Maximin*?
(d) Repeat the above for *miniMax Regret*